

The discovery of these important facts in the life history of the cattle tick is the result of the studies of Mr. E. C. Cotton, assistant entomologist of the Tennessee Experiment Station, and Mr. J. F. Voorhees, local forecaster in charge of the local office of the Weather Bureau at Knoxville, Tenn.

### ORCHARD HEATING IN INDIANA.

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NOTE.—The results reported by Mr. Walton are interesting in showing what may be accomplished under ordinary weather conditions in Indiana. The mean temperature for March, 1910, was the highest on record in the State, which caused trees and vegetation to be fully two weeks in advance of the development in ordinary seasons, on April 1. The reverse condition obtained during the latter half of April, when the lowest recorded temperatures broke all previous records for that time of the year, and were the temperatures that Mr. Walton attempted to combat in his orchard. His partial success demonstrates the practicability of orchard heating in the North Central States as a protective measure against frosts and freezing temperatures.—V. H. C.

Heaters holding 5 quarts of oil were placed in the orchard on March 31, 21 feet apart each way, with a small amount of straw on top to furnish sufficient heat to generate the gas. Our first frost occurred on April 6, and was noticeable by 6.30 p. m. It took three persons about 30 minutes to light the 500 fires, and inside of another half hour the temperature was 40° or above, which permitted the checking of alternate heaters. We began refilling the heaters after a couple of hours in order to prevent any possibility of the fires going out. The temperature went down to 27° in the unheated section of the orchard, but at no place in the heated area did it get below 32°. We let the heaters go out at 6 a. m., and as a result a little frost formed in low places before the sun was high enough to produce any warming effect.

Heaters were refilled on the 7th, and as frost settled at 7 p. m., the work of the previous night was repeated, and the heaters kept going until 6.30 a. m. As the sun came up everything outside the heated area was white with frost, and ice one-fourth inch in thickness had formed, while no frost whatever could be found in the orchard.

On April 12 a heavy frost began to appear at 11 p. m. In this case it was necessary to burn only alternate heaters, which were kept going until 6:30 a. m.

Snow fell throughout the night of April 17, but as the temperature did not fall below freezing, the fires were quenched a short time after they were started.

Not a single blossom had been injured within the heated area previous to the 22d. Currants hung in full clusters

with 10 or 11 on each stem. In the sections where heat had not been used blossoms were damaged to a considerable extent, the effect being most noticeable on currants where it was impossible to find more than 5 or 6 on a stem.

On April 22 a high northwest wind was blowing, with temperature at 32°. It was impossible to get the heat up into the trees with the wind blowing a gale. However, we held our own quite well until nearly daylight, when the temperature started downward. By 10 o'clock the thermometer read 25°, and the wind was still blowing hard. We kept the heaters going but the blossoms soon became like wax. We maintained the fight until the arrival of the weather forecast, which was for continued high winds and freezing temperature. At 11 a. m. nearly everything within the heated area as well as without was frozen, and caused us to forego our efforts, after having burned 3,300 gallons of oil. The freezing weather continued throughout the day and night of the 23d, 24th, and 25th, and was followed by heavy snow on the 26th. As a result we picked no gooseberries or currants from the 18 acres which were in bearing, nor any cherries, plums, or peaches, and but a few apples from the remainder of the orchard.

Having lost all tree and bush fruits we turned our attention to 1½ acres of strawberries that were not in blossom during the period of severe weather just described. We placed 180 heaters in this plat and went through three nights of frost with temperature down to 25° and lower. On the night of May 13 we started the fires at 8.30 p. m. and kept them going until 7 a. m. It was difficult to prevent the frost from settling on the vines, as there was no foliage above to assist in retaining the heat, as in the orchard. However, we went through the strawberry season without rain, and yet harvested a larger crop of berries than we did the previous year from a larger tract under more favorable moisture conditions. This goes to show that the heaters should at least share in the credit for the good results obtained.

We burned during the season about 4,000 gallons of fuel oil, which would have been sufficient in any ordinary year, or at least would have saved the crop had it been used during the springs of 1908 and 1909 instead of 1910.

We went into the matter this year to fight spring frosts, but when winter entered the fray we were compelled to surrender. We are not discouraged by the failure, however, and expect to try again in 1911. The experience gained is particularly valuable, and gives us increased energy for further experiment. It also convinces us that with proper equipment we can save our entire crop during seasons having ordinary weather conditions in spring.